QUARTERLY REPORT

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OCEAN OBSERVATIONS WITH EOS/MODIS: Algorithm Development and Post Launch Studies

by

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Following the format of my monthly reports, I shall describe developments (if any) in each of the major task categories.

1. Atmospheric Correction Algorithm Development.

a. Near-term Objectives:

(i) To produce a preliminary set of lookup tables which form the basis of the atmospheric correction algorithm for SeaWiFS --- the prototype of the MODIS atmospheric correction algorithm.

(ii) To begin development of an efficient scheme for implementing the proposed SeaWiFS atmospheric correction algorithm.

(iii) To explore the effects of earth curvature on the performance of the SeaWiFS correction algorithm.

b. Task Progress:

(i) The next step the in development of the atmospheric correction algorithm was to generate a set of coarse-grid lookup tables to apply the preliminary correction algorithm to SeaWiFS --- the testbed for the MODIS

algorithm. With the help of Bob Evans and Gene Feldman we have carried out 30,000 simulations (at approximately 1-1.5 hours per simulation) using spare CPU cycles on existing DECstations at RSMAS and GSFC which are dedicated to other projects. This procedure has worked for the coarse-grid set required for development of the SeaWiFS algorithm; however, more aerosol models must be added to the computational set to be assured that the models used for the lookup tables are representative of the range of aerosols likely to be encountered. To effect this in a timely manner more CPU power is required. This coarse grid set of computations will be used as a starting point for implementation tests of the SeaWiFS algorithm.

(ii) Task has not started.

(iii) A large number of computations have been carried out using our spherical shell atmosphere radiative transfer code to examine the influence of the curvature of the earth on atmospheric correction. Analysis of the results have begun. The principal results obtained thus far are:

(a) Surface roughness effects on the correction algorithm computed with the plane parallel atmosphere (PPA) approximation are virtually identical to those computed with the spherical shell atmosphere (SSA). Thus, it appears that the effect of surface roughness on the correction algorithm can be studied using the simpler PPA approximation.

(b) Earth curvature effects on atmospheric correction become important for solar zenith angles greater than about 70 deg., and become very large at zenith angles of 80 deg. However, by computing the Rayleigh contribution to the radiance at the top of the atmosphere using the more-appropriate SSA, the error usually can be reduced significantly. This suggests that for high-latitude imagery, the Rayleigh contribution should be computed using the SSA.

(c) The effect of multiple scattering on the correction algorithm appears to be the same for a PPA and a SSA. Therefore, it appears that modeling focussed on reducing the correction errors attributed to multiple scattering can be carried out using the simpler PPA approximation.

c. Anticipated Activities During the Next Quarter:

(i) Task of producing a preliminary set of lookup tables has been completed.

(ii) We shall begin development of a scheme for implementation of the preliminary SeaWiFS atmospheric correction algorithm. The goal is to have the algorithm running on an image processing system by the end of the quarter so that accurate estimates as to timing, lines of code, and storage requirements can be made.

(iii) We shall complete the analysis of the spherical shell atmospheres study, and try to develop a simple, computationally-fast, method of generating the Rayleigh scattering component of the sensor radiance in spherical geometry.

d. Publications: A manuscript ``Retrieval of watter-leaving radiance and aerosol optical thickness over the ocean with SeaWiFS: A preliminary algorithm'' by H.R. Gordon and M. Wang has been submitted for publication in Applied Optics. It describes the atmospheric correction algorithm we have proposed for SeaWiFS --- the MODIS prototype.

2. Whitecap Correction Algorithm.

a. Near-term Objectives: Obtain measurements of whitecaps at sea.

b. Task Progress: None, an attempt to image whitecaps with a Xybion camera from a ship off Hawaii (a piggy back experiment) failed because of the configuration of the ship.

c. Anticipated Activities During the Next Quarter: We plan to participate in an NRL experiment in which the Xybion camera will be flown in a P-3 aircraft over the Gulf Stream. Two surface ships will take meteorological and oceanographic data. This should provide the best possible test of the camera for use in whitecap studies.

3. In-water Radiance Distribution Schedule.

a. Near-term Objectives: Obtain measurements near MODIS bands at sea.

b. Task Progress:

c. Anticipated Activities During the Next Quarter:

4. Residual Instrument Polarization.

a. Near-term Objectives: None.

b. Task Progress: None.

c. Anticipated Activities During the Next Quarter: None.

5. Direct Sun Glint Correction.

a. Near-term Objectives: None.

b. Task Progress: None.

c. Anticipated Activities During the Next Quarter: None.

6. Prelaunch Atmospheric Correction Validation Schedule.

a. Near-term Objectives: Use sky radiance measurements in Monterey Bay in August to develop and test schemes for inverting them to retrieve the aerosol optical properties, especially the phase function at large scattering angles.

b. Task Progress: Data of Sky radiance and aerosol optical thickness were obtained during the Monterey Bay cruise. Images have been produced and those suitable for processing have been isolated.

c. Anticipated Activities During the Next Quarter: Initiate the analysis of the data using a radiative transfer code to extract the aerosol phase function and single scattering albedo. This will involve writing software to extract the digital data, writing an analysis program based on the paper ``Retrieval of the Columnar Aerosol Phase Function and Single Scattering Albedo from Sky Radiance over the Ocean: Simulations,'' (M. Wang and H.R. Gordon, Applied Optics 1993, Accepted), and carrying out the analysis. We expect to be able to identify the significant experimental and computational problems involved in the retrieval process and begin to address them.

7. Detached Coccolith Algorithm and Post Launch Studies.

a. Near-term Objectives: None.

b. Task Progress: None.

c. Anticipated Activities During the Next Quarter: None.

8. Post Launch Vicarious Calibration/Initialization.

a. Near-term Objectives: None.

b. Task Progress: None.

c. Anticipated Activities During the Next Quarter: None.

9. Single Scattered Aerosol Radiance and PAR Algorithms.

a. Near-term Objectives: None.

b. Task Progress: None.

c. Anticipated Activities During the Next Quarter: None.

OTHER DEVELOPMENTS

The PI participated in the MODIS Science Team meeting Mar 22-24.